

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. APPLN. NO.: 09/750,125

REMARKS

Review and reconsideration on the merits are respectfully requested.

Claim 1 has been amended to recite a preferred pressure range of from 6 to 100 MPa, based on the disclosure at page 11, last line. Also, the portion of dependent claim 8 relating to average cell diameter has been incorporated into claim 1, and claim 8 has accordingly been amended in this regard. Also, the subject matter of claim 11 has been incorporated into claim 1, and claim 11 has accordingly been cancelled. Moreover, the preferred characteristic impedance ratio disclosed at page 15, lines 5-8, has been incorporated into claim 1. Accordingly, claim 1 as amended now relates to a preferred embodiment of a microporous soundproofing material, which is clearly supported by the specification, and which is respectfully considered to be patentable over the cited art for the reasons discussed below.

Before turning to the rejections, Applicants note that the language of dependent claims 2, 3, 4, 8, 9, 10, 12 and 13 has been amended for clarification. None of the amendments to these particular claims is intended or does reduce the scope thereof. Instead, the language has been made consistent with that of amended claim 1 in certain locations, redundant terminology has been deleted and certain grammatical clarifications have been made.

Finally, Applicants have added new claim 16 directed to a method of improving the soundproofing performance of an electronic appliance, by applying the microporous soundproofing material of claim 1 inside the electronic appliance. The specification as a whole, including the Field of the Invention section on page 1, describes that the microporous

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soundproofing material of the present invention is preferably used inside of electronic appliances, to improve the soundproofing performance or properties thereof.

In view of the forgoing, no new matter has been added by any of the claim amendments or new claim added. Accordingly, entry and consideration of the claims in their amended form is respectfully requested.

In paragraph 2 at page 2, claims 1-15 stand rejected under 35 U.S.C. § 112 second paragraph, as allegedly being indefinite.

In claims 1-3, the Examiner argues that the phrase “high pressure” is vague and indefinite. The Examiner is requesting some numerical pressure limitation to be recited.

This rejection is respectfully traversed. As noted above, claim 1 has been amended in accordance with a preferred embodiment, wherein the pressure range is now defined as from 6 to 100 MPa. Dependent claims 2 and 3 have been amended to clarify that no different pressure range is intended therein. Accordingly, it is believed that the perceived ground of ambiguity has been overcome, and reconsideration and withdrawal of this aspect of the rejection is respectfully requested.

Regarding claim 10, line 3, the Examiner states that the unit of relative density is not specified. In response, Applicants respectfully note that, regarding the unit of relative density, page 13, last line to page 14, line 1 defines relative density as “density of expanded material/density of unexpanded material”. This means “density of material after expansion/density of material before expansion”. Therefore, the relative density does not have any unit (non-dimension).

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In view of the foregoing, it is respectfully submitted that one of ordinary skill in the art interpreting the language of claim 10 in light of the specification would have no difficulty understanding the metes and bounds thereof. As such, claim 10 is considered to be clear and definite, and withdrawal of this ground of rejection is likewise respectfully requested.

Claims 1-12 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over WO 99/47573 either individually, or “in view of admitted prior art for claim 2”. We interpret this rejection as claims 1 and 3-12 being rejected over WO ‘573 alone; claim 2 is rejected over WO ‘573 in view of admitted prior art.

The Examiner’s comments regarding WO ‘573 are set forth in the paragraph bridging pages 2-3, and are not repeated in their entirety herein. However, the Examiner generally argues that WO ‘573 is directed to low density microcellular thermoplastic elastomeric foams with closed cells, made using supercritical fluid CO₂ as the blowing agent. The Examiner argues that the polymer and the blowing agent are mixed in an extruder under high temperature and pressure, which are subsequently reduced to initiate foaming.

This rejection is respectfully traversed. WO ‘573 fails to defeat the patentability of Applicant’s claim 1 for at least the following reasons. Moreover, since claim 1 should be found patentable over WO ‘573, all of the remaining claims should be found patentable as well.

The microporous soundproofing material of the present invention has large characteristic impedance and excellent flexibility. In particular, the present invention provides a microporous soundproofing material suitable for use in electronic appliances that require follow-up properties to various shapes.

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The microporous soundproofing material of the present invention is suitably used as a soundproofing material for soundproofing noises generated from inside of electronic appliances.

The first aspect of the soundproofing material is high soundproofing properties. In general, soundproofing properties of a material are shown by a ratio ($Z_c^{\text{mat.}}/Z_c$) of characteristic impedance of the microporous soundproofing material ($Z_c^{\text{mat.}}$) to characteristic impedance of air (Z_c). In the soundproofing material of the present invention, uniform cells are present throughout the whole interior, particularly in the direction of thickness, and the cases that acoustic energy entered in a soundproofing material reflects at the cell interface are very large.

As a result, part of the acoustic energy is lost in the cells, and soundproofing properties are considerably improved.

The second aspect of the soundproofing material is that a compressive load at 50% compression is limited to 20 N/cm² or lower. As a result, such a soundproofing material has excellent flexibility. In particular, in the use of electronic appliances, the material is required to have high follow-up properties to shapes so as to closely contact with complicated shapes. Further, with decreasing thickness of circuit boards or the like, if the repulsive force of a soundproofing material is strong, a problem arises that the board warps. Therefore, the soundproofing material is required to have high flexibility.

The microporous soundproofing material according to the present invention is provided with both high soundproofing properties and flexibility, and therefore solves the problems in the prior art.

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In contrast to the present invention, WO '573 discloses an expanded material, but clearly fails to disclose or suggest the problems identified by Applicants, the physical properties of the soundproofing material recited in claim 1 which were discovered by Applicants to solve these problems, or even the use of the material as a soundproofing material. Moreover, the use in Applicant's most preferred practical application - on the inside of an electronic appliance so as to improve its soundproofing performance (see claim 16) - is not disclosed or suggested by WO '573.

In short, WO '573 does not contain any disclosure with regard to the soundproofing properties and also the flexibility of the expanded material. Therefore, Applicants respectfully submit that WO '573 does not teach or suggest the present invention as recited in claim 1 of the present invention.

In paragraph 5 at page 4, claims 13-15 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over WO '573 either individually, or in view of Nakae et al (U.S. Patent 4,353,817).

This rejection is respectfully traversed. Since this rejection relates to dependent claims only, such claims are patentable for at least the same reasons that independent claim 1 is patentable, as summarized above. Accordingly, at this time Applicants have not separately addressed these dependent claims on the merits, but rely on the distinction vis-à-vis claim 1. In view of this position, reconsideration and withdrawal of the rejection in paragraph 5 is respectfully requested.

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In paragraph 6, claims 1-15 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Cha et al (U.S. Patent 5,158,986). The Examiner argues that Cha is directed to a microcellular foamed material, and that Figure 14 shows a process of impregnating an unexpanded plastic material with a supercritical fluid, CO₂, at high pressure then decompressing and re-heating at a foaming station to induce foaming.

This rejection is respectfully traversed.

The problems identified by the inventors, and solved in accordance with the present invention have been summarized above vis-à-vis WO '573 rejection. Applicants respectfully submit that Cha fails to defeat the patentability of amended claim 1 for the following reasons.

In short, Cha does not contain any disclosure with regard to the soundproofing properties and also the flexibility of the expanded material. Therefore, Applicants respectfully submit that Cha does not teach or suggest the present invention as recited in claim 1 of the present invention.

In view of the foregoing, reconsideration and withdrawal of the rejection in paragraph 6 of the Office Action are respectfully requested.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Please cancel claim 11 without prejudice or disclaimer.

Please amend the claims as follows:

1. (Amended) A microporous soundproofing material [constituted of] comprising an expanded material formed through the step of impregnating a thermoplastic elastomer with an inert gas [at a] under high pressure of from 6 to 100 MPa and then decompressing the impregnated elastomer, wherein the expanded material comprises closed cells having an average cell diameter of from 0.1 to 300 µm uniformly distributed throughout the whole interior thereof, the expanded material has a compressive load at 50% compression of 20 N/cm² or lower, and wherein the ratio of characteristic impedance of the microporous soundproofing material to characteristic impedance of air ($Z_c^{mat.}/Z_c$) is from 5 to 50.

2. (Amended) The microporous soundproofing material of claim 1, [which is constituted of an] wherein the expanded material is formed [through the step of impregnating] from an unexpanded molding comprising the [a] thermoplastic elastomer [with an inert gas at a high pressure and then decompressing the impregnated molding].

3. (Amended) The microporous soundproofing material of claim 1, [which is constituted of an] wherein the expanded material is formed [by impregnating] from a molten thermoplastic elastomer, [with an inert gas at a high pressure and then subjecting] and the impregnated elastomer is subjected to molding simultaneously with decompression.

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4. (Amended) The microporous soundproofing material of claim 1, wherein the expanded material [constituting the soundproofing material] has undergone heating after the decompression.

8. (Amended) The microporous soundproofing material of claim 1, wherein the expanded material [constituting the soundproofing material has closed cells having an average cell diameter of from 0.1 to 300 μm evenly distributed throughout the whole inner parts thereof and] has a cell density of from 10^5 to 10^{14} cells per cm^3 .

9. (Amended) The microporous soundproofing material of claim 1, wherein the expanded material [constituting the soundproofing material has] comprises closed cells having an average cell diameter of from 0.1 to 20 μm evenly distributed throughout the whole [inner parts] interior thereof, and the expanded material has a cell density of from 3×10^8 to 10^{14} cells per cm^3 .

10. (Amended) The microporous soundproofing material of claim 1, wherein the expanded material [constituting the soundproofing material] has a relative density of 0.6 or lower.

12. (Amended) The microporous soundproofing material of claim 1, wherein the expanded material is made [of] from a mixture comprising [a] the thermoplastic elastomer and a thermoplastic polymer which is not a thermoplastic elastomer.

13. (Amended) The microporous soundproofing material of claim 1, wherein the expanded material [constituting the soundproofing material] contains a flame retardant.

Please add new claim 16.